STEEL SUCCESS STRATEGIES XXVII
PREPARE FOR THE TAKE OFF…BAD TIMES TO GOOD TIMES
Technology to the Rescue – Part I

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Siemens VAI Metals Technologies GmbH
New York, 2012-06-18
Megatrends define the future - Turn challenges into opportunities

<table>
<thead>
<tr>
<th>Megatrends</th>
<th>Global Challenges</th>
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<tbody>
<tr>
<td><strong>Climate Change</strong></td>
<td>- Sustainable developments of cities</td>
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<tr>
<td>▪ Highest CO₂ concentration in the earth atmosphere since 650,000 years</td>
<td></td>
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<td><strong>Urbanization</strong></td>
<td>- Effective, affordable health care</td>
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<td>▪ 23 Megacities in the year 2015</td>
<td></td>
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<td>▪ 2030: 60% of all people will live in cities</td>
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<td><strong>Demographic Change</strong></td>
<td>- Efficient production processes</td>
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<tr>
<td>▪ Generation 60+ will double worldwide until 2050 (from 11% to 22%)</td>
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<td><strong>Globalization</strong></td>
<td>-</td>
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<td>▪ 1950 to 2007: nearly 30-fold increase of global trade volume</td>
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Source: UN, Population Reference Bureau, World Population Data Sheet; WTO, International Trade Statistics; bpb
Extrinsic influences on the steel industry are drivers for a lifecycle partnership

- Global - Asia
- Growth & Crisis
- Vertical integrators

- New Co’s
- Mega size
- Applications

- Price
- Quality
- Low Grade Input

- Process flexibility
- Performance
- Differentiation

- CO₂
- Eco-friendly
- Shortages

Steel Industry

Market

Materials

Competition

Technology

Environment
Potentials in every phase of a plant’s lifecycle – Performance through partnership

Market introduction
- Research cooperations
- Lead customer strategy
- Leap frog technologies
- IPR sensitive

Growth phase
- New plants
- New products
- Service models
- Time to market
- USP & diff. sensitive

Maturity phase
- Modernisation competence
- Performance packages
- Products to upgrade
- Strong service aspect
- Price sensitive

Near end of lifetime
- Consultancy services
- Feasibility studies
- New investments or substantial replacements
- Competence sensitive
Trends in iron ore mining will influence ironmaking process routes decisions

<table>
<thead>
<tr>
<th>Type of run of mine</th>
<th>Coarse Hematite (He)</th>
<th>Coarse He Deeper fine He</th>
<th>Coarse &amp; fine He Rich Itabirite (It)</th>
<th>Fine He Rich &amp; poor It He/It decrease</th>
<th>Decrease He/It Poorer It He depletion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Products profile</td>
<td>Big lumps up to 200 mm</td>
<td>Lump ore natural sinter feed (SF)</td>
<td>Lump ore natural SF concentrate He</td>
<td>Lump ore natural SF concentrate SF, concentrate He &amp; It</td>
<td>Lump ore natural SF concentrate SF, concentrate It</td>
</tr>
<tr>
<td>Decades</td>
<td>1940’s</td>
<td>50/60’s</td>
<td>70’s</td>
<td>80/90’s</td>
<td>2000’s</td>
</tr>
</tbody>
</table>
The role of raw material quality and gas availability for ironmaking process selection is obvious.

Ore with high iron content:
- Screening
  - Lump ore
  - Fines
    - Sintering
      - Blast furnace

Ore with low iron content:
- Beneficiation
  - Concentrate
    - Pelletizing
      - FINEX plant
      - DR plant
      - COREX plant

- Less CO₂ by use of nat. gas
- Less CO₂, off-gas used for power or DR plant
- Less CO₂, use of off gas for red.
- CO₂ Emission baseline

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Primary end has largest potential of waste heat recovery in iron & steelmaking plants

Waste heat recovery – “CO₂ free” provision of process steam and electrical power
Energy efficiency turns into money -
The new Quantum EAF

- < 280 kWh/t with scrap
- Reduced power installation
- 100% scrap preheating
- Pure flat bath operation
- Charging, tapping, taphole refilling during power – on
- Minimized furnace movements
- Lowest tap-to-tap time of 33 minutes
- Low noise emissions

1. Offgas treatment
2. Scrap loading
3. Scrap charging
4. Scrap preheating
5. EAF
Cutting of process time with continuous melting – FAST Slag Free Tapping

- Continuous DRI melting
- Integrated siphon system allows power-on during taphole refilling
- Pure flat bath operation
- Lowest flicker and net disturbances
Form follows function - Expanding the product envelope to cope with market demands in casting & rolling

- **Ultra thick slabs**
  - Shouqin CC3, China
  - Slab thickness up to 400 mm (16”)

- **Ultra large blooms**
  - Section size up to Ø1200 mm (47”)

- **Ultra thin HRC**
  - ESP plant Arvedi, Italy
  - Coil 0.8 x 1500 mm (0.03” x 59”)

- **Thick coiled plate in a HSM**
  - AM FSMer Powercoiler, France
  - 1.2 – 25.4 x 2100 mm (0.05” – 1” x 83”)
  - HSS grades
Pushing the limits of mechanical properties by metallurgical treatment during manufacturing

- cold forming and heating
- pressing and hardening
- 1500 MPa

Source: voestalpine – phs (press hardening steels) - patented
**Widening the product portfolio by metallurgical modelling and new equipment capabilities**

| Casting |  |  
|---------|---|---
| **DynaPhase** | Prediction of phase transformation in real-time |  
| **Dynacs 3D** | Assure predefined strand surface temperature distribution |  
| **DynaGap Soft Reduction** | Optimal roll gap adjustment |  

**Intensive cooling section with power cooling**

**Optimum surface quality and solidification with soft reduction**

- DynaGap System
- DynaGap practice setup
- Gap setpoints for:
  - Tapered strand gap
  - DynaGap Soft Reduction®
  - Liquid core reduction

*more than 140 strands installed worldwide!*

**Rolling**

- **Microstructure control**
  - Since Year 2000
  - Before Year 2000

- **Cooling curve control**
  - Since Year 2006
  - Coiling temperature control

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Endless operation – another step towards Just-in-Time production

**WinLink** – Endless production of long products

1. Scrap yard
2. EAF
3. LF
4. Billet caster
5. Rolling Mill
6. Induction heating
7. Water treatment facility
8. Dispatch area

**ESP** – Endless strip production – From liquid steel to HRC in just 7 minutes

- 90–110 mm
- 70–90 mm
- 10–20 mm
- 0.8–12.7 mm
- 180 m
The role of LiquiRob® solutions to increase the safety conditions in liquid steel area

- In BOF's: Sublance / ThyssenKrupp CSA, Brazil
- In EAF's: Temperature measuring / Neuves Maisons, Fra
- In casters: Cellax measurement / voestalpine CC7, Austria
- Oxy lancing of ladle / voestalpine CC7, Austria
Integrated Condition Monitoring System - Value adding knowledge management solution

Production plant

- Mechatronics
  - Fingerprints

- Technological controls (level 1)
  - Fingerprints

- Process models (level 2)
  - Fingerprints

Vibration monitoring
- Fingerprints

Additional systems
- Fingerprints

CM InfoPackages (snapshots)

Production team

CM InfoBroker

Plug&Play
IT4Metals - Manufacturing Execution System -
The steps towards a digital plant operation

ERP
Enterprise Resource Planning

MES
Manufacturing Execution System

Automation
Distributed Control System

Business Administration
Connected Server
Production Control Systems
Process Level

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